Assignment 9

Ratio, Proportion and Variation; Dependence, Functions and Formulas; Complex Numbers

Textbook Assignment: Chapters 13, 14, 15 (158-164)

9-1. A radio operator has a top code speed of 45 words per minute. How fast can he take code compared with an average operator who has a speed of 36 words per minute?

1. $1\frac{1}{4}$ times as fast
2. $1\frac{1}{5}$ times as fast
3. $1\frac{3}{4}$ times as fast
4. $1\frac{4}{5}$ times as fast

9-2. When ratios are used to compare two quantities, the quantities must be stated in the same units.

9-3. Which of the following ratios is equivalent to the inverse of the ratio 42:48?

1. $\frac{3}{4}$
2. $\frac{4}{3}$
3. $\frac{7}{8}$
4. $\frac{8}{7}$

9-4. Which of the following expresses the ratio of 8 ft 3 in. to 3 in., when reduced to its lowest terms?

1. 2 ft 9 in.
2. $\frac{8 \text{ ft } 3 \text{ in.}}{3 \text{ in.}}$
3. $\frac{33}{1}$
4. $\frac{99}{3}$

9-5. The usual methods of expressing the same proportion are

1. $\frac{3}{6} = \frac{1}{2}$; 3:6 = 1:2; 3:6::1:2
2. $\frac{3}{6} = \frac{1}{2}$; 3:2 = 1:6; $\frac{3}{1} = \frac{6}{2}$
3. 3·6:1·2; $\frac{3}{6} = \frac{1}{2}$; 3:6 = 1:2
4. 3 - 6 = 1 - 2; $\frac{3}{6} = \frac{1}{2}$; 3:6 = 1:2

9-6. What are the means in the proportion 2:3 = 10:15?

1. 2 and 3
2. 2 and 10
3. 3 and 10
4. 3 and 15

9-7. In the proportion $\frac{a}{b} = \frac{c}{d}$ the extremes are

1. a and c
2. a and d
3. c and b
4. d and c

9-8. In a proportion, where does the factor of proportionality appear?

1. In the means
2. In the extremes
3. In the numerators of both ratios
4. In the numerator and denominator of one ratio

9-9. What is the factor of proportionality in the proportion $\frac{9}{17} = \frac{63}{119}$?

1. 3
2. 4
3. 7
4. 8

9-10. The proportion $\frac{x}{2} = \frac{9}{16}$ is equivalent to the equation

1. $9x = 8$
2. $9x = 32$
3. $16x = \frac{9}{2}$
4. $16x = 18$

9-11. What is the value of x in the proportion $\frac{3}{x} = \frac{x}{11}$?

1. 14
2. 33
3. $\pm\sqrt{14}$
4. $\pm\sqrt{33}$

9-12. What is the third proportional in a proportion whose first proportional is 15 and whose mean proportional is 105? [Hint: In a proportion with equal inner terms; x:y = y:z, z is called the third proportional.]
1. 585
2. 615
3. 735
4. 1,575

9-13. What is the value of x in the proportion $\frac{a}{x} = \frac{b}{c}$?

1. $\frac{a}{bc}$
2. $\frac{ac}{b}$
3. $\frac{b}{ac}$
4. $\frac{bc}{a}$

9-14. If the numbers a, b, c, and d are in proportion in the arrangement $\frac{a}{b} = \frac{c}{d}$, there are other arrangements of a, b, c, and d which will form a proportion.

9-15. Which of the following proportions is obtained from the proportion $\frac{a}{2} = \frac{7}{b}$ by inversion?

1. $\frac{a}{2} = \frac{b}{7}$
2. $\frac{a}{7} = \frac{b}{2}$
3. $\frac{2}{a} = \frac{b}{7}$
4. $\frac{7}{a} = \frac{2}{b}$

9-16. If $\frac{m}{n} = \frac{p}{q}$, the proportion formed by alternation is
1. m:p = n:q
2. n:m = q:p
3. n:q = m:p
4. p:m = q:n

9-17. A post and a flag pole, both vertical to the ground, cast shadows of 3 ft and 10 ft, respectively. If the post is 6 ft 6 in. tall, how tall is the flag pole?
1. 19 ft 6 in.
2. 20 ft
3. 21 ft 8 in.
4. 65 ft

9-18. A 3-foot scale model is made of a ship that is actually 180 feet long. Let x = the scale length of a mast that is actually 40 feet long. Which of the following proportions will express the relationship between the mast length of the model and the mast length of the actual ship?
1. $\frac{180}{3} = \frac{40}{x}$
2. $\frac{3}{40} = \frac{180}{x}$
3. $\frac{3}{x} = \frac{40}{180}$
4. All of the above proportions

9-19. How many seconds does a chronometer lose in a week if it loses 9.0 seconds in 30 days?
1. 2.1 sec
2. 2.4 sec
3. 3.3 sec
4. 3.8 sec

9-20. If a destroyer travels at the rate of 24 knots, how long does it take to go 84 nautical miles?
1. 3.1 hr
2. 3.2 hr
3. 3.3 hr
4. 3.5 hr

9-21. The depth of water at a beach increases smoothly from zero at the shore to 120 feet at a distance of 2,000 yards out. How close to the shore can a small craft with a draught of 3 feet come without running aground? [Note: 2,000 yards must be converted to feet before working the problem.]
1. 90 ft
2. 150 ft
3. 160 ft
4. 180 ft

9-22. A ship's radar screen has a target blip showing inside the 20,000-yard range circle. If the radius of the 20,000-yard range circle is 5 inches, and the blip is $3\frac{3}{4}$ inches from the center of the screen, how far is the target from the ship?
1. 11,000 yd
2. 13,000 yd
3. 15,000 yd
4. 17,000 yd

9-23. Which of the following is a situation in which x varies directly as y?

1. $x = \frac{4}{y}$
3. $xy = 6$
2. $x = xy$
4. $x = \frac{7}{16}y$

9-24. If x is directly proportional to y as in $x = by$, the expression b is called the
1. mean proportional
2. arbitrary constant
3. third proportional
4. constant of proportionality

9-25. How may the rule that the perimeter (P) of a square is directly proportional to the length of the side (S) be expressed?

1. $P = 4S$
3. $P = kS^2$
2. $P = k/S$
4. $P = k + S$

9-26. As x increases, y decreases but the product xy is constant, is an expression of inverse variation involving variables x and y.

9-27. Which of the following expressions illustrates inverse variation?

1. $x = ky$
3. $x = \frac{k}{y}$
2. $kx = y$
4. $x = k + y$

9-28. If 8 men can do a job in 7 days, 24 men can do the same job in how many days?

1. $2\frac{1}{3}$
3. 14
2. 3
4. 21

9-29. How does F vary in the equation $F = \frac{kmm^1}{d^2}$?

1. Jointly as m and m^1, and inversely as k
2. Jointly as m and m^1, and inversely as d^2
3. Jointly as k and d, and inversely as m and m^1
4. Jointly as k and d^2, and inversely as m and m^1

9-30. Which of the following is an example of joint variation?

1. $A = LW$
3. $C = 2\pi D$
2. $A = \pi r^2$
4. $P = 4S$

9-31. The power dissipated by a resistor varies directly as the square of the applied voltage and inversely as the magnitude of the resistance. How will the amount of dissipated power change if the resistance is doubled and the voltage is halved?
1. It will increase to twice its original value.
2. It will increase to four times its original value.
3. It will decrease to one-eighth its original value.
4. It will decrease to one-fourth its original value.

9-32. What is the dependent variable in the formula for the area of a circle, $A = \pi r^2$?

1. r
3. π
2. r^2
4. A

9-33. In standard practice for any formula of the form $y = 2z$, y is the independent variable.

9-34. If the length of a rectangle is tripled and the width is multiplied by five, the area is multiplied by

1. 3
3. 8
2. 5
4. 15

9-35. What is meant by the notation $y = f(x)$?
1. y is f times x.
2. y is bigger than x.
3. y is a function of x.
4. y is not related to x.

9-36. For the function $y = \frac{1}{x}$, which of the following statements is true?
1. If x is halved, y is halved.
2. If x is doubled, y is halved.
3. If x is doubled, y is doubled.
4. If x is increased, y is increased.

9-37. In the formula

$$X_c = \frac{10^6}{2\pi fC},$$

which of the following changes will result in a decrease in X_c?
1. A decrease in C
2. A decrease in f
3. An increase in C
4. Each of the above

9-38. What is the subject of the formula

$$V = \frac{4}{3}\pi r^3?$$

1. r
2. r^3
3. $\frac{r}{3\pi r^3}$
4. V

9-39. A formula differs from an equation in that the subject of a formula normally appears
1. on both sides of the equality sign
2. together with other variables
3. without subscripts
4. only once

9-40. The symbols R_1 and R_2 differ and are read

R prime and R double prime.

9-41. Which of the following formulas can be derived from the formula

$$V = \frac{1}{3}\pi r^2 h?$$

1. $r = \sqrt{\frac{3V}{\pi h}}$
2. $h = \frac{1}{3}\pi r^2 V$
3. $\pi = \frac{3V}{rh}$
4. $r = \frac{3}{2}Vh\pi$

9-42. How should the formula

$$T = \frac{r^2}{4} + L$$

be rewritten so that the new subject is r?

1. $\pm 2\sqrt{T + L}$
2. $\pm 2\sqrt{T - L}$
3. $4(T - L)$
4. $\pm 4\sqrt{T - L}$

9-43. What is the value of A given by the formula

$A = 2s^2 + 4sh$ if s = 19 and h = 25?

1. 2,622
2. 2,648
3. 2,662
4. 2,688

9-44. If $e_o = \frac{e_i R_2}{R_1 + R_2}$, and $e_o = 75$, $e_i = 120$, and $R_2 = 5{,}000$, what is the value of R_1?

1. 1,000
2. 2,000
3. 3,000
4. 4,000

9-45. When L equals length and H equals height, both in feet, R equals gallons required per one square foot of area, and Q equals quantity of paint in gallons, what formula should be used in estimating the total quantity of paint required to paint a large bulkhead?
1. Q = LH + R
2. Q = LR + H
3. Q = LHR
4. $Q = \frac{LH}{R}$

9-46. If V = the volume of a cylinder, h = its height, and r = its radius, what is the formula which indicates that the volume of a cylinder is equal to π times the square of the radius times the height?

1. $V = \frac{\pi r^2}{h}$
2. $V = \frac{r^2 h}{\pi}$
3. $V = \pi r h^2$
4. $V = \pi r^2 h$

Height in feet (H)	Time in seconds (t)
2,600	5
4,400	10
5,400	15
5,600	20

Table 9A.--Height-time relationships.

9-47. Table 9A shows the relationship between the height reached by a shell fired with an upward velocity of 600 feet per second and the time of flight. Which formula expresses this relationship?
1. $H = 600t + 16t^2$
2. $H = 600t - 16t^2$
3. $H = 600t^2 + 16t$
4. $H = 600t^2 - 16t$

9-48. The formula

$$R_t = \frac{R_1 R_2}{R_1 + R_2}$$

shows the relationship between the total resistance R_t of a parallel circuit and the two individual resistances, R_1 and R_2. When you solve this formula for R_1, you get a formula that says R_1 is equal to the

1. sum of R_2 and the total resistance divided by the product of R_2 and the total resistance
2. sum of R_2 and the total resistance divided by R_2 minus the total resistance
3. product of R_2 and the total resistance divided by the sum of R_2 and the total resistance
4. product of R_2 and the total resistance divided by R_2 minus the total resistance

9-49. Which of the following completes the table?

V	0	$\frac{\pi}{3}$	$\frac{4\pi}{3}$	3π	$\frac{16\pi}{3}$	$\frac{25\pi}{3}$	?
r	0	1	2	3	4	5	6

1. 10π
2. 12π
3. $\frac{35\pi}{3}$
4. $\frac{40\pi}{3}$

9-50. Which of the following statements is reflected by the formula

$$A = \frac{H}{2}(B_1 + B_2)?$$

1. The area of a figure is twice the height and the sum of the bases.
2. The area of a figure equals one half of the height times the sum of base 1 and base 2.
3. The area of a figure is two less than the height multiplied by the sum of the bases.
4. The area of a figure equals the height multiplied by base 1 added to one half of base 2.

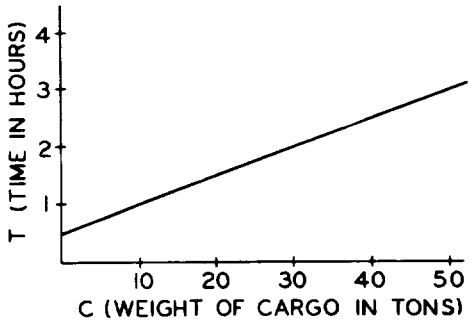

Figure 9A.--Graph showing weight-time relationships.

9-51. The graph in figure 9A shows that the time required to load a certain type of cargo varies with the amount loaded. What formula for the time consumed can be derived from the graph?

1. $T = \frac{1}{2}(C + 1)$
2. $T = \frac{1}{2}\left(C + \frac{1}{2}\right)$
3. $T = \frac{1}{2}\left(\frac{C}{10} + 1\right)$
4. $T = \frac{1}{2}\left(\frac{C + 1}{10}\right)$

9-52. Figure 14-5 in your textbook depicts two ships leaving port at the same time. If the 1st ship leaves port at 1000 hours on a constant heading and the 2nd ship leaves port at 1100 hours on a different constant heading, how many miles will each ship have traveled when they are the same distance from port?

1. 10 miles
2. 30 miles
3. 50 miles
4. 65 miles

9-53. The real number system consists of

1. real and imaginary numbers
2. complex, rational, and irrational
3. integers, irrational numbers, and complex numbers
4. rational, irrational, positive and negative numbers

9-54. An imaginary number occurs in the solution of the equation $x^2 - 9 = 0$.

9-55. In the imaginary concept, both i and j are used to represent the square root of minus 1.

9-56. Reduce $\sqrt{-27}$ to its simplest form.

1. $i\sqrt{27}$
2. $3\sqrt{3i}$
3. $3i\sqrt{3}$
4. $-3\sqrt{3}$

9-57. When the expression $\sqrt{-98}$ is reduced to its simplest form, what is its appearance?

1. $i\sqrt{98}$
2. $7\sqrt{2}$
3. $7i\sqrt{2}$
4. $7\sqrt{2i}$

9-58. Imaginary numbers are a product of the imagination and have no physical meaning.

9-59. Which of the following numbers is real and greater than zero?

1. i
2. i^2
3. i^3
4. i^4

9-60. Which of the following equations yields an imaginary number when solved for x?
1. $x(x + 2) = 2x + 5$
2. $x(x + 2) = 2x - 5$
3. $x(2x + 1) = x + 1$
4. $x(2x - 1) = 1 - x$

9-61. What is the result when the expression i^{10} is reduced to its basic value?
1. -i
2. i
3. -1
4. 1

9-62. The simplest method of expressing i^{43} is
1. -i
2. i
3. -1
4. 1

9-63. Operation with -1 is equivalent to a rotation of how many degrees?
1. 0
2. 90
3. 180
4. 360

9-64. The rotation resulting from multiplication by 2i is twice the rotation resulting from multiplication by i.

9-65. Multiplying a number successively by i four times results in a rotation of how many degrees?
1. 60
2. 90
3. 180
4. 360

9-66. In the complex plane, the vertical axis is called the **axis of imaginaries**.

● In answering items 9-67 through 9-69, refer to figure 9B.

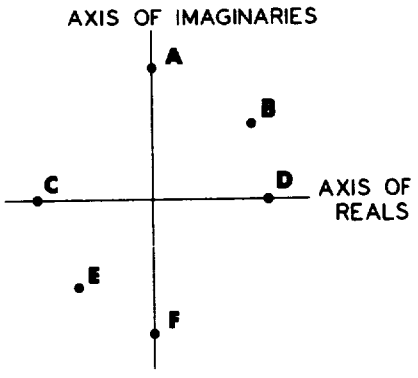

Figure 9B.--Numbers plotted in the complex plane.

9-67. The product of which two numbers is a real number less than zero?
1. A and D
2. A and F
3. C and D
4. C and F

9-68. Which number is a pure imaginary?
1. A
2. B
3. C
4. D

9-69. Which number is of the form a + bi, where both a and b are less than zero and the number a is a real part and bi is the imaginary part of the complex number?
1. A
2. B
3. D
4. E

9-70. In which quadrant is the complex number -3 + 4i plotted?
1. First
2. Second
3. Third
4. Fourth

9-71. The complex number 0 + 3i is a pure imaginary.

9-72. What is the proper procedure for finding the length of the vector representing a number in the complex plane?
1. Add the real and imaginary coefficients and square the sum.
2. Multiply the real and imaginary coefficients and take the square root of the product.
3. Square the real and imaginary coefficients, add the squares, and take the square root of this sum.
4. Square the imaginary coefficient, multiply by the real coefficient, and take the square root of this product.

9-73. A vector represents both direction and magnitude.

9-74. The length of a vector represented by -3 -4i is
1. 3 units
2. 4 units
3. 5 units
4. 7 units

9-75. Refer to figures 15-8 and 15-9 in your textbook. If a vector is designated by the value -6 + 8i, where is it located?
1. Left of the Y axis and above the X axis
2. Left of the Y axis and below the X axis
3. Right of the Y axis and above the X axis
4. Right of the Y axis and below the X axis